guages such as BASIC.

Typical laboratory applications of systems like the foregoing would be automated calibration and calculation, as well as process control for existing instruments lacking their own built-in microprocessors. Over the past several years we have used this approach for numerous multichannel instruments and have found it to be flexible, rugged, and thrifty.

The Hewlett-Packard 9800 series of desk-top units, beginning with the 9815 and extending to the 9845, offers data acquisition and computing facilities ranging from extremely simple to very sophisticated. Prices start at around $1,500 and go as high as $20,000 for a basic instrument. The desk-top computers are particularly desirable as dedicated instrument data processors since they contain, in a single package, data storage on magnetic tape, a small thermal printer, and an LED display or CRT for interaction with the operator. The series is supplemented with a large assortment of interface protocols, each of which is brought into play through a "read only" memory on a special, plug-in card.

Another system designed specifically for instrumentation is the MINC packaged laboratory system sold by the Digital Equipment Company. This system, which has a base price of $12,500, is built around the LSI-11/12 microcomputer; it has two floppy discs, a graphics CRT terminal, and an instrumentation box that accommodates a wide variety of input/output devices.

Stand-alone applications

Laboratory accounting and billing systems can be excellent applications for stand-alone microcomputers. The applications can range from a complete ledger and billing system for an independent laboratory, to the reformatting of a standard hospital accounting system for specific use by the laboratory; the hardware for such a system would cost from $10,000 to $30,000, depending on the vendor and the options purchased. The ability of a hospital laboratory to generate its own management reports can lead to better cost understanding and control than can be obtained through the usual hospital accounting system.

Although accounting data will probably have to be entered manually into the laboratory computer, this once-a-month effort will pay off with the ability to reformat the data and to present each supervisor with a cost and statistical report reflecting the monthly laboratory budget, actual costs incurred, and variances from the budget. Executive summaries can also be prepared, with ratios to analyze the efficiency of manpower use versus both historic data and in relation to such standards as the College of American Pathologists workload reporting system. Programs for budget and workload use can be written from scratch or adapted from packaged, general ledger programs for small businesses.

Other uses for stand-alone microcomputers are analysis and storage of quality control data, calculation of RIA calibration curves, drawing of histograms of bacterial antibiotic sensitivities, and many more.

Conclusions

The new generation of microcomputers offers something for everyone. For those already using a computer, microcomputers provide an alternative to computer replacement in meeting upgrading and expansion needs in the laboratory. For those without previous experience in automated data processing, microcomputers allow an inexpensive entry into this field, for specific projects with a predictable payout. Perhaps one of the most certain results is that the microcomputer user will gain experience and insight into the capabilities of computers, while reducing the risk of costly future misadventures. LM

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